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Channel Islands National Park

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**Sand Beach and Coastal Lagoon Monitoring
Santa Rosa Island
1994 Annual Report**

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ABSTRACT

Approximately 20 percent of the shoreline of the California Channel Islands is sandy beach. This contrasts with about 80 percent of the southern California mainland coast being sand beach. Though often overlooked, sandy beach communities may harbor high densities of organisms hidden within the interstices of the sand grains. These organisms play a vital role in the food web of shorebirds and fish.

Sand Beach monitoring was implemented on Santa Rosa Island in 1994 following the design protocol established by Dugan et al. 1993. This adds an integral part of the marine ecosystem to the long-term monitoring program at Channel Islands National Park. Various sampling methods were employed at eight beaches to describe the biological characteristics of the beach. These methods included bird censuses, physical measurements, clam gun (core) transects of both the upper beach and washzone, and point contact transects to measure macrophyte wrack on the beach. Pismo clams (*Tivela stultorum*) were sampled in both the intertidal and subtidal at Southeast Anchorage. Salinity, temperature, and depth measurements were made in three coastal lagoons.

Beach sampling was performed in September and November. Temperature recorders were in place from April to December in the Old Ranch House Canyon Lagoon and at the mouth of Old Ranch Canyon Creek/Lagoon from April to July. Pismo clams were sampled in April and November.

Old Ranch House Canyon Lagoon varied from brackish to hypersaline. Temperatures varied greatly both seasonally and daily. Ranges of 14°C during one day were commonly observed. The highest diversity of birds was observed around the lagoon.

Macrophyte wrack, mostly kelp (*Macrocystis pyrifera*) and surfgrass (*Phyllospadix* spp.), was most abundant on Sandy Point and Soledad West beaches and consequently invertebrates reached their highest diversity and abundance there. Beachhoppers (amphipods) were quite dense numbering nearly 30,000 per meter of beach. Isopods, kelp flies (*Coelopa vanduzeei*), and predatory beetles were also common.

Sand crab (*Emerita analoga*) populations varied in composition and abundance. Sandy Point had the greatest densities, reaching nearly 40,000 per meter of beach.

Olive snails (*Olivella biplicata*) were quite common in the protected waters at Southeast Anchorage. The densities found, nearly 7500/m, were higher than those found by Dugan et al. 1993.

A total of 97 pismo clams were captured for mark-recapture population estimates. Based on the recapture of three clams in November, a population estimate (using the Petersen single mark recapture formula) of 619 clams was made. This equals only about 25% of the population estimates made during the design study. Density estimates of clams; however, were within the ranges found during the design study. Four clams from the 1989 transplant were recaptured and had grown from 26 to 35 mm.

We found an invasive alien weed, giant reed (*Arundo donax*), growing on Bee Rock beach. This weed has potential to change the character of the beach ecosystem if left uncontrolled.

INTRODUCTION

Sand beaches are a major component of the intertidal region of the northern Channel Islands. On Santa Rosa Island, sand beaches make up approximately 30 km of shoreline with a wide variety of exposures and beach types.

A design study for sand beach monitoring on Santa Rosa Island was completed in 1990 (Dugan et al. 1990). A draft report summarizing the inventory and design study was completed in February 1993 (Dugan et al. 1993). In 1994, the first efforts to implement the monitoring protocol were undertaken, adding this important component to the long-term monitoring efforts at Channel Islands National Park. The design of the sand beach monitoring provides a look at the intertidal fauna of the beaches and coastal lagoons of Santa Rosa Island. Physical characteristics of both beaches and lagoons were also measured. This report presents the data collected in 1994 and makes recommendations about fully implementing sand beach monitoring in the park.

METHODS

Study Area

The California Channel Islands comprise eight islands located at various distances from the Southern California mainland, of which five are included in Channel Islands National Park. Santa Rosa Island (21,854 ha) has the most extensive beaches of the park Islands.

A variety of beach exposures are found on Santa Rosa Island ranging from low to high wave energy. Both temporal (storm activity) and geographic (exposure) differences influence the physical properties of beaches including slope, grain size, permeability, cusping, and stability. The physical properties in turn affect the beach fauna. Sampling sites were established by Dugan et al 1990 to represent the range of exposures

and beach types found on Santa Rosa Island (Figure 1).

Sand Beach and Lagoon Monitoring Methods

Sampling techniques used are outlined in a monitoring handbook for sand beaches and coastal lagoons (Dugan et al. 1990). Lagoon temperatures were read at the various stations with handheld thermometers held just below the surface and at 10 cm depth. HOBOTEMP[™] temperature loggers were placed near the stage height recorder at Old Ranch Canyon Lagoon and at station 4 at Old Ranch House Canyon Lagoon in April. The loggers were attached to concrete blocks and placed so that the units would be suspended approximately 10 cm from the bottom. Temperature readings were taken by the units every 96 minutes. Sampling dates are listed in Table 1.

Standard beach sampling was conducted during September or November 1994 at eight of the nine beaches recommended for monitoring in the handbook. Standard beach sampling included: five upper beach clam gun transects to estimate the abundance of beachhoppers, *Megalorchestia* spp., and associated species; five wash zone clam gun transects to estimate abundance of sand crabs and isopods including *Emerita analoga*, *Excirolana chiltoni* and associated species; three point contact transects for percent cover and composition of macrophyte wrack; size frequencies of sand crabs; physical measurements; bird census. Sea temperatures were taken by wading into the surf and reading a thermometer held at 10 cm depth. Beach slope was measured using a level and ruler to measure the rise of the slope. The slope was calculated in Excel as the arctangent of the rise over the run multiplied by the conversion factor for expression in degrees.

Pismo clams, *Tivela stultorum*, were monitored by counting siphons during 100 m band transects. The band transects were conducted by two snorkelers swimming perpendicular to shore counting siphons within parallel 1 m wide

SAND BEACHES AND COASTAL LAGOONS MONITORING 1994 ANNUAL REPORT

swaths separated by 2 m. Four sets of transects were conducted on 4 November. Intertidal populations were surveyed in 25 cm wide trench transects dug perpendicular to shore during low tide. Abundance, size frequency, and reproductive conditions for spiny sand crabs, *Blepharipoda occidentalis*, were also collected during the trench transects. Ten transects were dug on 20 April and five were dug 4 November. Additional clams were collected during snorkeling searches on both dates and by limited random pitchforking in the intertidal in April. All collected clams were marked with a single groove on the lower left valve and returned to their respective zones. Olive shells, *Olivella biplicata*, were sampled in subtidal clam gun transects at Southeast Anchorage.

RESULTS

Physical Measurements

Lagoon measurements were taken on 19 April, 7 September, and 1 November. Temperature and salinity data are presented in Table 1. Oat Point Lagoon was dry on both of the latter sampling dates. The gauge at Station 1 at Old Ranch Canyon Lagoon was also dry on those occasions, though water was flowing out the mouth of the creek.

Temperature loggers were installed at Old Ranch Canyon Lagoon approximately 3 m northeast of the station 1 gauge, 15 cm deep on 20 April and at Old Ranch House Canyon Lagoon next to the station 4 gauge, 38 cm deep on 20 April. Because the units were attached to a concrete block on the bottom, the depth over time was variable as the water level changed. Temperatures were recorded every 96 minutes. Both units were retrieved on 7 September and new units deployed at this time. Both units were floating on the surface in September.

Data are presented in figures 7-8. While quite variable on a daily basis, temperatures in Old Ranch Canyon Lagoon were fairly consistent over the three months of operation (figure 7). A second unit placed there in September was

washed away during the winter storms. Several dramatic temperature changes were recorded in Old Ranch House Canyon Lagoon (figure 8). The highest temperatures were recorded in August. Daily temperatures fluctuated as much as 14°C with the highest temperatures occurring in mid-afternoon and lowest around sunrise.

Changes were noted between visits on 19 and 20 April (Table 1). Temperatures dropped and Old Ranch Canyon Lagoon was flowing on the 20th when it was not on the 19th.

Ruppia maritima and *Trichocorixa reticulata* were present in all three lagoons in April. Fish fry were present at all locations at Old Ranch House Canyon Lagoon in April.

Ocean temperatures ranged from 15°C to 18°C with the colder temperatures occurring in November (Table 1). Salinity ranged from 32-34 ppt with no discernible pattern. The calculated beach slope was nearly equal for each beach at 3.1°. Physical parameters for the beaches are presented in Table 2.

Bird Census

Bird census data are presented in Table 3. No birds were recorded on the beaches at Sandy Point, Ford Point, Southeast Anchorage, or Becher's Bay. The highest diversity of birds was found at Abalone Rocks with six species. In all, 11 species of birds were recorded from the beaches including Oat Point where the count includes the beach as well as the lagoon.

Tivela Stultorum Pismo Clams

Tivela stultorum were sampled at Southeast Anchorage on April 20 on an incoming tide of 0.3 ft. Ten intertidal transects were dug in the area of the third cove. The first transects were over 20 m long and the last was about 10 m long because of the incoming tide. The transects yielded 12 clams ranging in size from 79 mm to 152 mm (Table 4, Figure 2). A total of 45.35 square meters of beach were excavated yielding a clam density of 0.26 per square meter of beach. Two clams from the transects were previously marked in 1989 as transplants, one intertidal and the other subtidal. Random pitchforking was

done between the transects and yielded four unmarked clams and four marked clams (one each intertidal and subtidal transplant and two natives) (Table 4). Three snorkelers, searching for a total of 4.5 hours, collected 51 clams at a depth of 1-3 m (Table 5). One marked native clam was collected. All unmarked clams from the intertidal and subtidal were marked with one groove on the lower left valve (LL1) (figure 3) and returned to their respective habitat. The sizes of subtidal clams ranged from 81 mm to 158 mm (figure 2).

Tivela stultorum were again sampled on November 4, during an outgoing tide to -1.2 ft. Subtidal transects covering a total of 1600 square meters offshore from the third beach area, yielded 61 clams or 0.04 clams/m² (Table 6). Five intertidal transects were dug in the area of the third beach. A total area of 22.78 square meters yielded only one unmarked clam, 150 mm (Table 4) or 0.04 clams/m². Two snorkelers searched a total of two hours and collected 28 clams from 1-3 m depth. Visibility was reduced as the tide went out, making it more difficult to see siphons than during the transects. Two marked native clams, one marked in 1989, the other in 1991 were collected along with three marked in April 1994 and 24 unmarked clams. All the clams were marked with the 1994 mark, one groove on the lower left valve (LL1) (figure 3).

Because the transplanted clams had marks cut into the shell margin we can approximate the growth of those clams since October 1989. The subtidal clams grew 27 and 34 mm to 115 and 87 mm respectively in 1994. Growth of the intertidal clams was the same at 26 and 35 mm to 92 and 80 mm respectively.

Olivella biplicata were observed on all the subtidal transects. Other organisms observed during the transects were *Blepharipoda occidentalis*, southern kelp crab *Talipes nuttali*, slender rockcrab *Cancer gracilis*, sand dollar *Dendraster* sp., fat nassa snail *Nassarrius perpinguis* (unverified ID), hermit crabs *Pagurus* sp., halibut *Paralichthys californicus*, sanddab *Citharichthys* sp., topsmelt *Atherinops* sp., barred surfperch *Amphistichus argenteus*, shovelnose guitarfish *Rhinobatos productus*, and thornback ray *Platyrrhinoidis triseriata*.

Olivella biplicata Purple Olive Snails

Five low intertidal clam gun transects were made on the first beach at Southeast Anchorage with a total of 171 cores over 98 m. A total of 520 snails were collected giving an average of 7,493 snails per meter of beach. Shell length ranged from 9 mm to 24 mm (figure 4). A few *Emerita*, *Blepharipoda*, polychaetes, isopods were collected on the transects (Table 7).

Blepharipoda occidentalis Spiny Sand Crab

Intertidal *Blepharipoda occidentalis* were collected in trench transects in April and November at Southeast Anchorage. In April, a total of 134 crabs were collected in 10 transects yielding an average of 2.5/m² or 53.6/m of beach (Table 8). Sizes ranged from 22-48 mm for males, 24-40 mm for ovigerous females, and 30-45 mm for non-ovigerous females (figure 5a).

In November, 66 crabs were collected in five transects yielding an average of 2.3/m² or 52.8/m of beach (Table 8). Sizes ranged from 29-51 mm for males, 34-50 mm for ovigerous females, and 28-42 mm for non-ovigerous females (figure 5b). One male *Lepidopa californica*, pearl crab, (carapace length = 12 mm) was found in the transects.

Macrophyte Wrack

Macrophyte wrack data are presented in Table 9, and summarized in Table 9b. Transects were not conducted at Southeast Anchorage, but very little wrack was observed there. Ford Point, Becher's Bay, Water Canyon, and Abalone Rocks had very little wrack, mostly small dried pieces of *Phyllospadix* sp., and fragments of *Macrocystis pyrifera*. *Macrocystis* wrack was quite common at Sandy Point (18% cover) and Soledad West (13% cover) piled up to depths of 20 cm and 6 cm respectively. Soledad West had the greatest overall cover at 20.4%.

Upperbeach Transects

Results of the upperbeach clam gun transects are shown in Table 10 and are summarized in Table 11b. Transect widths varied according to the beach characteristics. Becher's Bay had the narrowest upper beach area (5 m) and waves washed against the cliff at high tide. Soledad West (29 m) and Sandy Point (32 m) had the longest upper beach transects. At Sandy Point the high tide reaches the cliff. Small dunes and vegetation back the beach at Soledad West; however, *Megalorchestia* spp. were found in highest abundance on Sandy Point followed by Soledad West. Water Canyon, Bee Rock, and Becher's Bay had only moderate amounts of beachhoppers.

Isopods, *Alloniscus perconvexus* were present in low to moderate abundances on all beaches except Water Canyon and Becher's Bay. Staphylinid beetles were found on all beaches except Water Canyon. They were quite active at both Bee Rock and Sandy Point. Other beetles were most abundant at these two sites. *Excirolana chiltoni* were present in upper beach transects at all beaches except Ford Point and Abalone Rocks, and were most abundant at Water Canyon and Becher's Bay.

Wash Zone Transects

Wash zone transect data are presented in Tables 11 and 13. *Emerita analoga* densities in the transects ranged from none at Abalone Rocks to 39,027 per meter of beach at Sandy Point. *E. analoga* megalopa were found at in low numbers at all beaches except Abalone rocks and Soledad West. Ovigerous crabs were found at all beaches except Ford Point and Becher's Bay which were sampled in November and Abalone Rocks which had a very low density. *Excirolana chiltoni* were found at all seven beaches in densities from 3/m² to 381/m². *Euzonus mucronata* and *Nephtys californiensis* were present in low densities at most beaches. Of note, *E. mucronata* was present at an average density of 148/m² at Becher's Bay.

Supplemental sampling for sand crab size frequencies supplemented the wash zone transects at all beaches except Becher's Bay

where crab numbers were low (Table 12). Size frequency samples were taken approximately 50 m from the transects at Abalone Rocks where higher densities could be seen. Non-ovigerous females made up the majority of the samples except at Abalone Rocks where males were more common. Soledad West had the most ovigerous crabs where 24% of the females were ovigerous. Sandy Point had the largest number of small crabs and megalopa. The largest crabs were found at Water Canyon. The smallest ovigerous crabs were found at Sandy Point in sieve #18 (corresponding carapace length 10.8 mm). Reproductive characteristics are summarized in Table 14 and size frequencies are shown in figures 6a-6c.

General observations

A few plants of giant reed (*Arundo donax*) were discovered growing on Bee Rock beach and were removed. Dead canes of giant reed were found on several of the beaches. The canes apparently wash down the mainland creeks during the heavy winter rain, and are carried out to the islands by currents.

After completing the sampling at Sandy Point (8 September 1994), we checked the crescent beach on the south facing side of the point and observed 16 *Mirounga angustirostris* and no *Phoca vitulina*.

A dolphin carcass (probably a common dolphin) was encountered on the Old Ranch House beach in April and measurements were taken. Bones of a second skeleton were found between Oat Point and Old Ranch lagoon.

DISCUSSION

General characteristics for Santa Rosa Island beaches are listed in Dugan et al. 1993. No major changes were noted in 1994.

Temperature loggers worked well except that their depth continually changed as the water level in the lagoon changed. Daily temperatures fluctuated greatly but it is unknown when the units were floating on the surface and subject to

SAND BEACHES AND COASTAL LAGOONS MONITORING 1994 ANNUAL REPORT

solar radiation. Since the recorders were placed at depth; however, we can assume that for at least the first few days the recorders were completely submerged. Many of the major changes in the daily temperature fluctuations seem to coincide with spring tides. On October 31st, the temperature changed 14°C during a six hour period in Old Ranch House Canyon Lagoon. Daily temperature variations, which had been 12-14°C, before that were reduced to only 2°C. October 31st was the beginning of a spring tide series with a 5.7 ft tide in the morning. What often happens during spring tides is that the lagoon will fill with overwash during high tide, reducing the temperature fluctuation. Change also occurs when the lagoon fills, either with seawater or freshwater runoff, and there is sufficient pressure to break through the berm allowing the lagoon to empty. Changes in the temperature regime occurred in mid-May and July 1st, both periods of neap tides.

Some of the most dramatic temperature changes seem to coincide with spring tides that overwashed the beach and filled the lagoon. Old Ranch Canyon Lagoon was mostly backed-up creek water occasionally overwashed by spring tides. It was generally fresh to brackish, and usually was open to the ocean with some flow out the mouth. During the dry part of the year, Oat Point Lagoon is entirely overwash, becoming hypersaline as the water evaporates. During the rainy season, there may be enough runoff from the surrounding area to make the water brackish. More often the lagoon there is dry.

Most organisms remained within the density ranges reported by Dugan et al (1993). Sandy Point and Soledad West had the largest amounts of wrack on the beach and consequently had the highest diversity and density of both upper- and lowerbeach invertebrates (Table 13). *Excirolana* were the only invertebrates common on both upper beach and washzone transects, and were found in much higher numbers in the washzone. Beachhopper amphipods were quite dense on those beaches reaching nearly 30,000 per meter of beach. Interestingly though, *Excirolana chiltoni* were found in moderate numbers at Becher's Bay and Water Canyon where there was little wrack and beachhopper

numbers were low. The morphology and exposure of these beaches are likely responsible for the amount of debris trapped on the beach.

Sandy Point had exceptionally high numbers of *Emerita*, beachhoppers, and *Excirolana*. Bee Rock also had high numbers of *Emerita*, but much lower numbers of beachhoppers and *Excirolana*. The higher numbers of Staphylinid beetles may play a role in the lower numbers of beachhoppers observed.

Olivella biplicata aggregate in protected subtidal sand flats and exhibit patchy distribution.

The density of nearly 7500/m is higher than densities found in transects by Dugan et al. (1993). The mean density of 374 snails/m² is greater than that found during the design study (226/m²), but is less than the estimated 6780 snails/m² from subtidal sampling (Dugan et al. 1993).

Size structure and composition of *Emerita analoga* populations were quite different on different beaches. Highest densities of sand crabs were found on Sandy Point at nearly 40,000/m. Abalone Rocks did not have any sand crabs within the transects, though some were found for size frequency measurements. Water Canyon had larger ovigerous females and the highest percentage of ovigerous females (Table 14). No ovigerous crabs were found on the two beaches sampled in November. This is consistent with previous work that abundance decreases and ovigerous crabs are gone by early winter.

A total of 97 *Tivela stultorum* was captured during the two samples in April and November. Three of the clams marked in April were recaptured in November. During the design study from 1989-1991, 242 native clams were marked with a horizontal notch. Five of these marked clams were recaptured in 1994.

In October 1989, 1151 clams (approximately 1-3 years old) were transplanted to Southeast Anchorage from Pismo Beach, San Luis Obispo county. One half of the clams were marked with a notch near the hinge ligament on the valve edge and transplanted into the subtidal. The others were marked with a notch opposite

SAND BEACHES AND COASTAL LAGOONS MONITORING 1994 ANNUAL REPORT

the hinge ligament on the valve edge and placed into the intertidal (Dugan et al. 1993). Two clams transplanted into the intertidal and two clams transplanted into the subtidal were recaptured in April. Growth estimates appear to be the same for both intertidal and subtidal transplants. The larger clams grew more slowly in length as might be expected.

Considering only the 1994 captures, the population estimate using the Petersen single mark recapture formula is 619 clams. This population estimate is only 25% of the 1990 estimates (Dugan et al. 1993). Densities ranged from 0.26/m² in the intertidal during April to 0.04/m² in both the intertidal and subtidal November samples. Both densities are within ranges found during 1989-1990 (Dugan et al. 1993).

RECOMMENDATIONS

Pismo clams are of particular interest since they are found in only two confirmed locations at the Channel Islands (Southeast Anchorage, Santa Rosa Island and Christy Beach, Santa Cruz Island). Pismo clams are highly sought after by sportfishers. There is no closed season and clams may be taken within the national park. There is a limit of ten clams with a minimum size of 4.5 inches (114 mm). The park should consider petitioning the California Fish and Game Commission to protect these populations. Just one charter dive boat could decimate the clam population at Southeast Anchorage.

More time needs to be allocated to sand beach monitoring than was afforded to it in 1994. Ten days are needed for the standard beach sampling at all sites. Two separate shorter trips may be more practical. In addition, extra time is needed for sampling *Tivela stultorum*, about two days in each of the summer months. The lagoon sampling should be able to squeeze into that schedule without additional days. Working the incoming tide was difficult, making it impractical to sample two beaches in one day. A crew size of four worked well with teams of two taking on separate tasks. We were able to quickly count

and release all the organisms sampled that way. For sampling clams, three is the minimum number of people when doing subtidal transects. In the intertidal, the larger the crew the better.

The use of temperature loggers in the lagoon is giving interesting results and will help us understand the physical dynamics of the system better. Depth and conductivity recorders would also provide valuable information. Continued efforts to get complete data from the lagoons needs to be worked into the protocol schedule.

The sand beach monitoring protocol needs to be expanded to Santa Cruz and San Miguel Islands. Beaches need to be chosen and new procedures may be required. The California Coastal Commission is funding marine baseline inventory and monitoring in Santa Barbara, Ventura, and Los Angeles counties. Currently only one-time surveys are planned for San Miguel and Anacapa Islands. Channel Islands National Park will cooperate and assist with establishing new protocol and filling in any gaps in the present program at the islands.

Ideally, monitoring all sites described in the handbook should be completed each year in order to build the most complete understanding of sand beach dynamics. Program costs are limited to personnel time and transportation to the island.

If sampling must be limited, it is recommended that pismo clams be sampled every other year. Each year half of the beach sampling should be completed, sampling the other half the following year. The selection of beaches should allow for as broad a range as possible. Transportation to the island and to the sites presents the greatest difficulty so there is no need to cut back on any of the actual monitoring protocol at any beach.

Regular beach patrols should be part of the monitoring and could be performed by island staff. Information about beached birds and marine mammals would be useful baseline data for future Natural Resource Damage Assessments and may alert management to potential or existing problems. Regular physical information will aid in our understanding of beach dynamics. Regular surveys would give early warnings about alien species invasions. For example, *Arundo donax*, if

established, would be difficult and costly to eradicate. This plant has the potential to change the beach ecosystem greatly.

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Table 9

| Beach Macrophyte wrack transect data | | | | | | | |
|--------------------------------------|--------|--------------|------------|---------------|--------|-------|-----------------------------|
| Location | Date | Species | Transect # | Point Spacing | Length | Count | Average Ht. |
| SRIWC#7 | 940906 | Egria | 2 | 0.25 | 25 | 1 | |
| | | | | | | | E=1cm |
| SRIAR#5 | 940907 | Phyllospadix | 1 | 0.25 | 25 | 3 | |
| SRIAR#5 | 940907 | Phyllospadix | 2 | 0.2 | 20 | 3 | |
| SRIAR#5 | 940907 | Macrocystis | 3 | 0.25 | 25 | 1 | |
| SRIAR#5 | 940907 | Macrocystis | 1 | 0.25 | 25 | 1 | |
| | | | | | | | P=2cm, M=0.67cm |
| SRISW#9 | 940907 | Macrocystis | 1 | 0.5 | 50 | 7 | |
| SRISW#9 | 940907 | Macrocystis | 2 | 0.5 | 50 | 17 | |
| SRISW#9 | 940907 | Macrocystis | 3 | 0.5 | 50 | 14 | |
| SRISW#9 | 940907 | Phyllospadix | 1 | 0.5 | 50 | 7 | |
| SRISW#9 | 940907 | Phyllospadix | 2 | 0.5 | 50 | 5 | |
| SRISW#9 | 940907 | Phyllospadix | 3 | 0.5 | 50 | 11 | |
| | | | | | | | P=7.7cm, M=12.7cm |
| SRIBR#2 | 940908 | Phyllospadix | 1 | 0.5 | 50 | 7 | |
| SRIBR#2 | 940908 | Phyllospadix | 2 | 0.5 | 50 | 8 | |
| SRIBR#2 | 940908 | Phyllospadix | 3 | 0.25 | 25 | 10 | |
| SRIBR#2 | 940908 | Macrocystis | 1 | 0.5 | 50 | 5 | |
| SRIBR#2 | 940908 | Macrocystis | 2 | 0.5 | 50 | 1 | |
| SRIBR#2 | 940908 | Macrocystis | 3 | 0.25 | 25 | 2 | |
| SRIBR#2 | 940908 | Egria | 1 | 0.5 | 50 | 1 | |
| SRIBR#2 | 940908 | Egria | 3 | 0.25 | 25 | 2 | |
| | | | | | | | P=8.3cm, M=2.7cm, E=1cm |
| SRISP#1 | 940908 | Macrocystis | 1 | 0.5 | 50 | 12 | |
| SRISP#1 | 940908 | Macrocystis | 2 | 0.5 | 50 | 22 | |
| SRISP#1 | 940908 | Macrocystis | 3 | 0.5 | 50 | 20 | |
| SRISP#1 | 940908 | Phyllospadix | 1 | 0.5 | 50 | 1 | |
| SRISP#1 | 940908 | Phyllospadix | 2 | 0.5 | 50 | 1 | |
| | | | | | | | P=0.67cm, M=18cm |
| SRIFP#4 | 941106 | Macrocystis | 1 | 0.1 | 12.5 | 4 | |
| SRIFP#4 | 941106 | Macrocystis | 2 | 0.1 | 18.8 | 1 | |
| SRIFP#4 | 941106 | Macrocystis | 3 | 0.1 | 13.6 | 1 | |
| SRIFP#4 | 941106 | Phyllospadix | 2 | 0.1 | 18.8 | 1 | |
| SRIFP#4 | 941106 | Phyllospadix | 3 | 0.1 | 13.6 | 1 | |
| | | | | | | | P=0.67cm, M=2cm |
| SRIBB#8 | 941107 | Red Algae | 1 | 0.1 | 12.2 | 1 | |
| SRIBB#8 | 941107 | Macrocystis | 1 | 0.1 | 12.2 | 1 | |
| SRIBB#8 | 941107 | Phyllospadix | 1 | 0.1 | 12.2 | 8 | |
| SRIBB#8 | 941107 | Phyllospadix | 2 | 0.1 | 12.7 | 10 | |
| SRIBB#8 | 941107 | Phyllospadix | 3 | 0.1 | 12.1 | 13 | |
| SRIBB#8 | 941107 | Macrocystis | 3 | 0.1 | 12.1 | 3 | |
| | | | | | | | RA=0.3cm, P=10.3cm,M=1.3cm, |